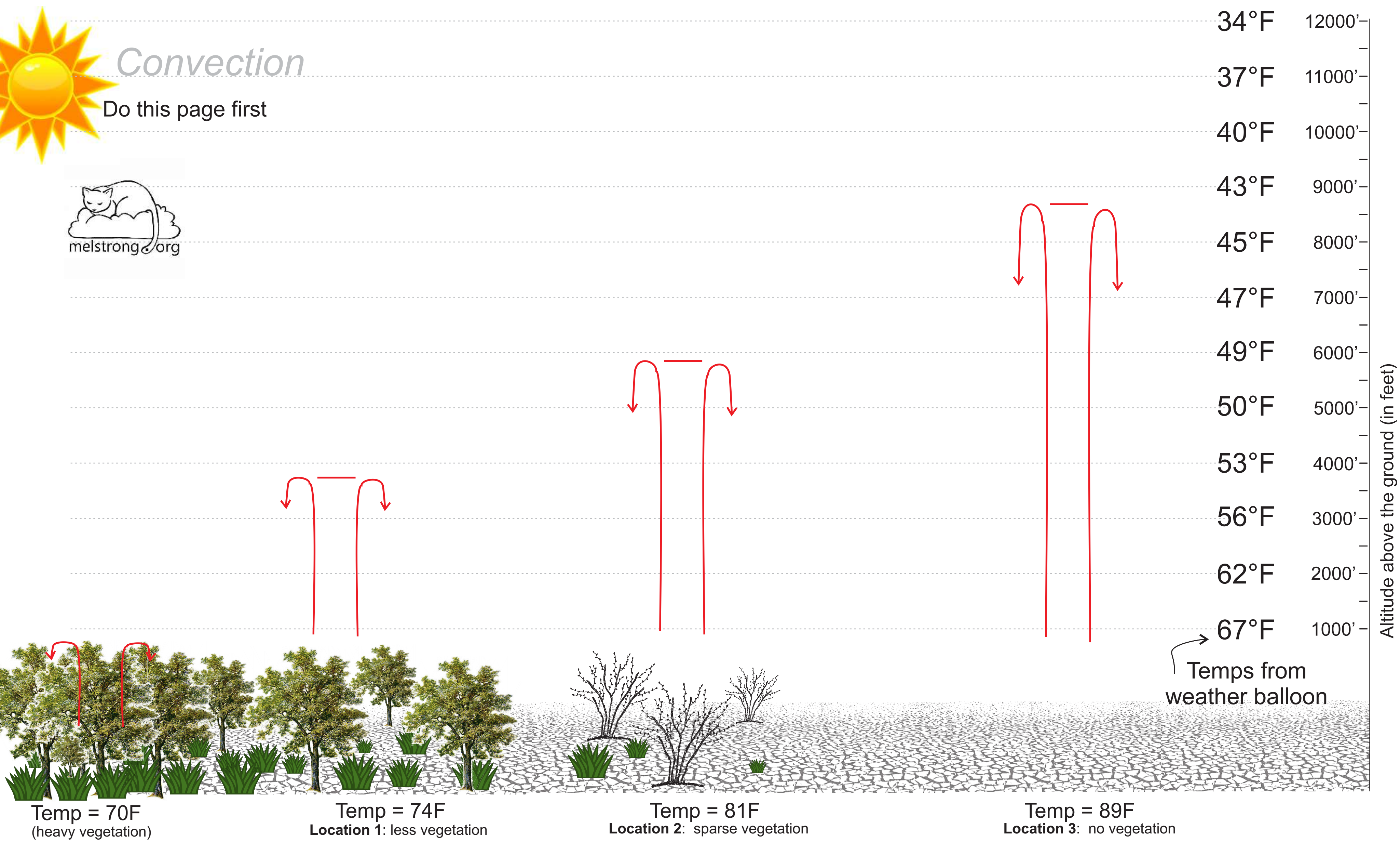
Convection

Do this page first

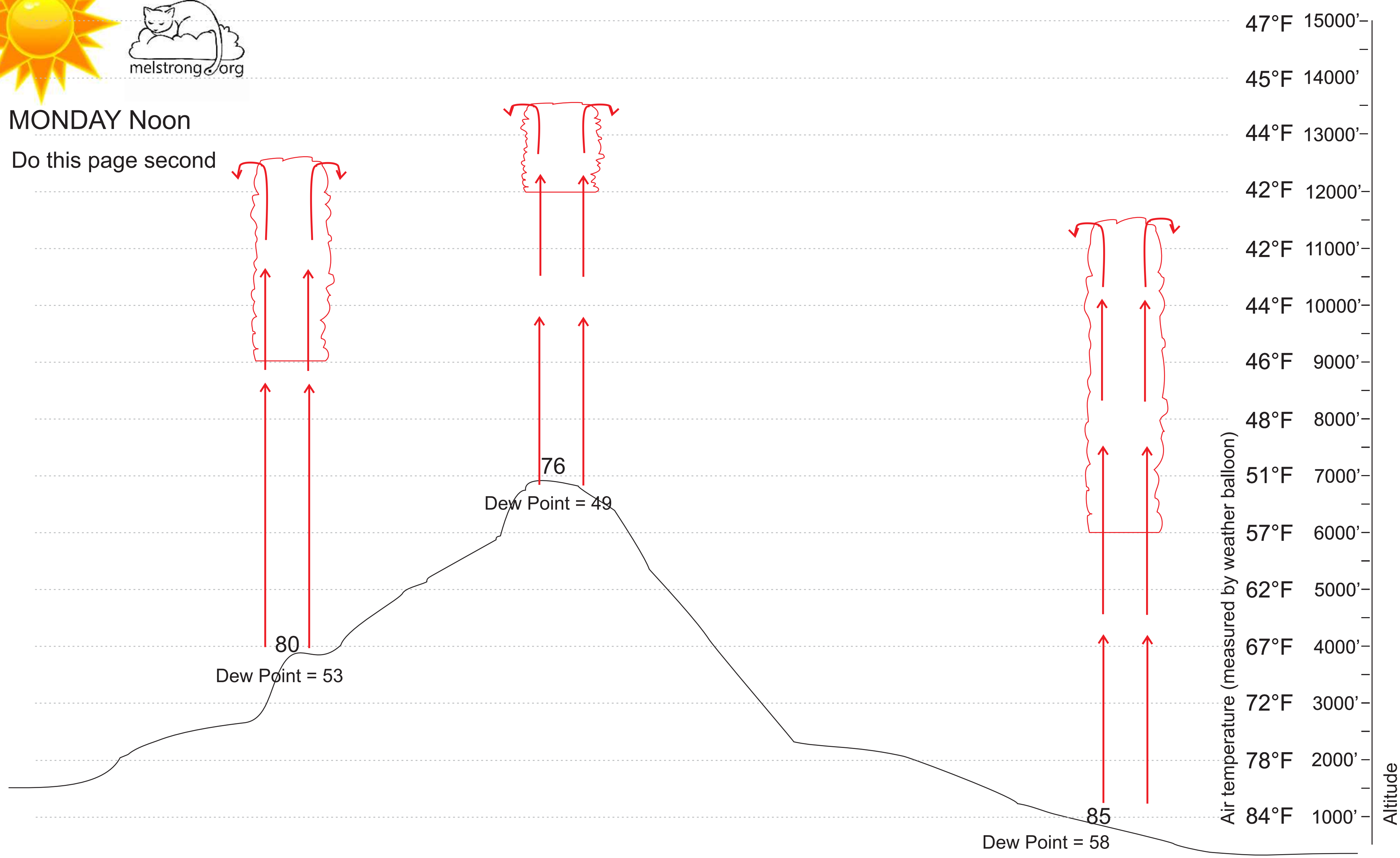


In the above scenario, the sun is shining down on terrain with different amounts and types of vegetation. The ground heats up to the temperatures shown at the surface. A weather balloon is sent up which records the environmental temperatures (shown on the right). The air is perfectly dry with zero humidity - *there will not be any clouds present here.*

For each of the **four locations**, determine how high the plume of warm air (the 'thermal') will rise before sinking back down. To do this, use the dry adiabatic lapse rate of 5.4°F/1000 ft. On the diagram above, **draw in the maximum height** each of the three thermals would reach with a line segment. <u>Then draw the circulation pattern to show each of the four thermals</u> (use arrows to show the path of the air). HINT: don't know how to start? Start with the surface temperature in each location, and calculate the temperature drop for each thermal as it climbs each 1000 foot segment....pencil these in and compare with the balloon data. Horizontal guidelines are shown to help you.

MONDAY Noon

Do this page second

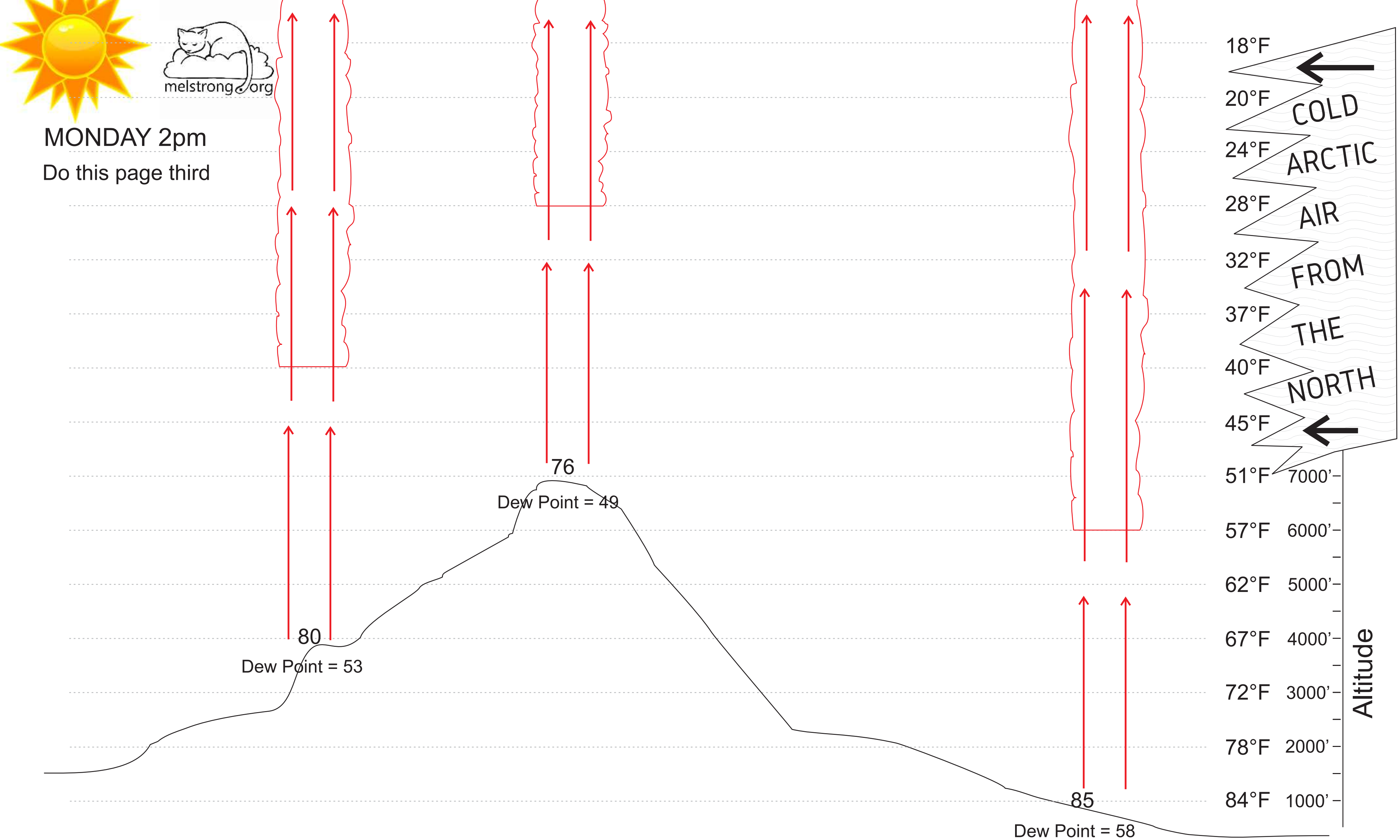


Monday at noon the sun is shining down across the Jemez mountains. A weather balloon is launched and reports the temperatures as shown to the right. For each of the three locations, draw in where cumulus clouds would form in each of the three locations. You need to determine the bottom and top of the cloud for each of the three locations. If the top of the cloud grows off the top of the paper, then show it doing just that. Draw in the sides of the clouds so it is clear where they are. Use arrows to show direction of air movement (convection) <u>including any motion that is occurring inside of the cloud</u>.

Procedure: Use the dry adiabatic lapse rate to follow each parcel of air as it rises (5.4°F/1000ft). Pencil in the temperature change for each 1000 ft. Once the parcel of air has cooled to its dew point, you have found cloud base. From there, proceed upward from cloud base using the wet adiabatic lapse rate (2.7°F/1000ft). As long as the parcel keeps rising (warmer than the environmental temperature) then the cloud keeps growing. If the parcel of air is not warmer than the air around it, the cloud stops growing.

MONDAY 2pm

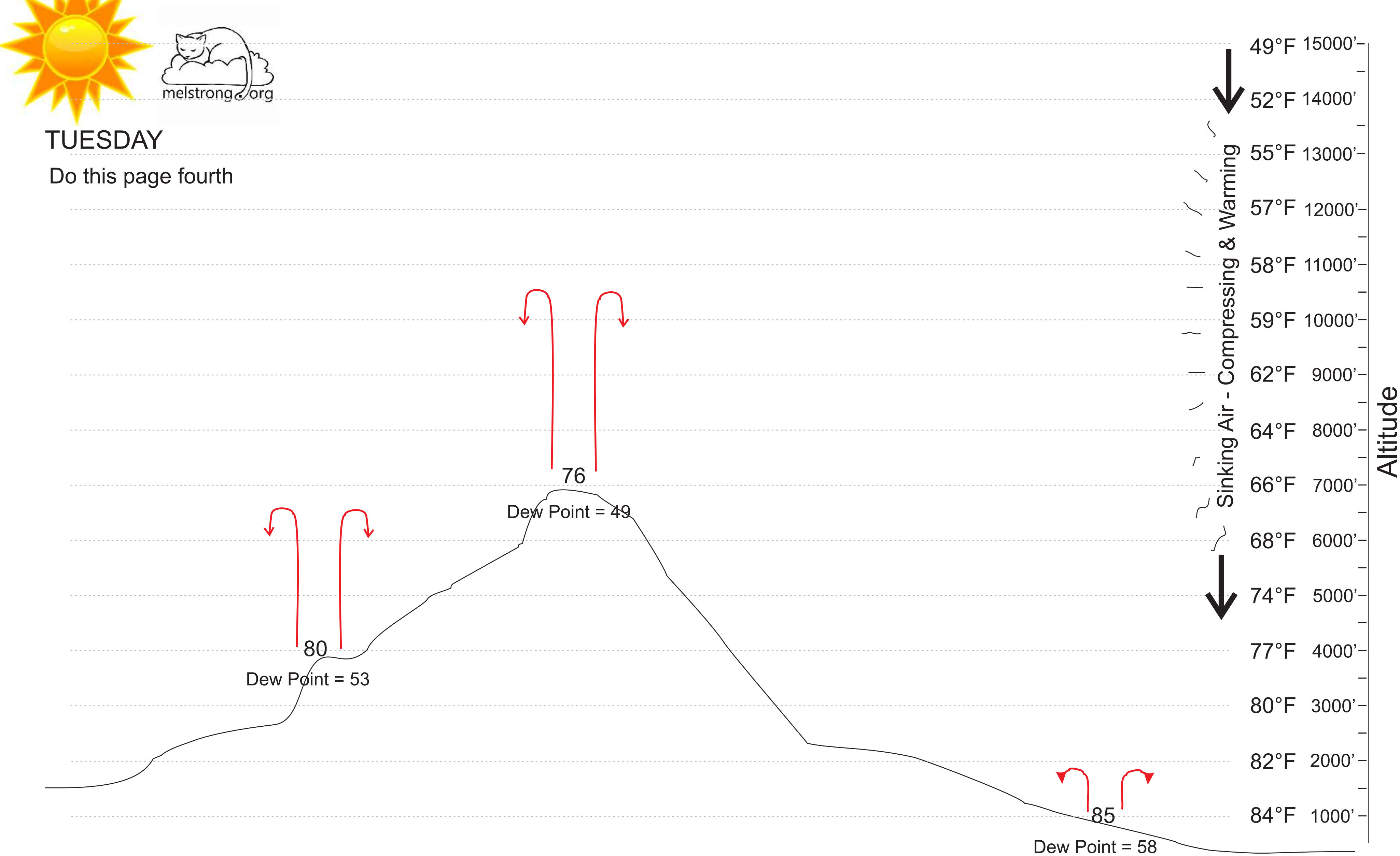
Do this page third



A little later that same day over the Jemez Mountains, upper winds from the north bring in some unusually cold air aloft (above the surface). We will just assume that the surface temperatures and dew points are still the same as before. A new weather balloon captures these new conditions aloft and the new temperatures are shown to the right.

How does this change the cloud formations from the previous page? The cooler air aloft allows our air parcels to easily rise. This makes our clouds taller. Draw in the new cloud boundaries. <u>Use arrows to show direction of air movement.</u>

Would you consider this air stable or unstable? (no additional math is needed to figure this out) This is unstable air.



The next day, air is sinking down over New Mexico. This sinking air (called a 'high pressure system') causes the air aloft to warm a bit due to compressional heating. Let's assume that the ground temperature and dew point temperature have not changed from the previous day.

How does this sinking air change the cloud formations? The warmer air aloft prevents convective cells from reaching their dew point. The rising air sinks back down before a cloud is formed. Draw in the new cloud boundaries. <u>Use arrows to show direction of air movement.</u>

Would you consider this air stable or unstable? This is stable air.